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Original Article

Monitoring of Ovarian Follicular Development and Ovulation with Transvaginal Sonography (TVS) in Infertile Women in Eastern Region of Nepal

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Abstract

Background

Ultrasonography is the first line imaging modality for evaluation of ovaries, monitoring ovarian follicular development and detecting ovulation in infertile women; thus plays a significant role in infertility management. This study was undertaken to evaluate the pattern of ovarian follicular growth and to predict and detect ovulation in infertile women by transvaginal sonography in eastern region of Nepal.

Material and Methods

Hospital based prospective cross-sectional study on 100 infertile patients referred for ultrasonographic monitoring of ovarian follicle was conducted over duration of 26 months. Serial transvaginal sonography of the patients was performed using standard procedure daily from day 10 of menstrual cycle till detection of ovulation. Identification of ovarian dominant follicle, monitoring of dominant follicle development and detection of ovulation was assessed in relation to the day of menstrual cycle.

Results

Increase in mean diameter of the dominant follicle was seen in serial ultrasound scan till ovulation, which occurred in all cases by day 16 of menstrual cycle. The average daily follicular growth rate \pm SD from day 10 of menstrual cycle till detection of ovulation was 2.2 ± 0.2 mm per day and the mean diameter \pm SD of dominant follicle on the day prior to ovulation was 21.4 ± 2.8 mm (range: 17.2 – 26.3 mm).

Conclusion

Transvaginal sonography is an excellent method for monitoring of ovarian follicular development and shows a linear increase in mean diameter of dominant follicle from day 10 of menstrual cycle till detection of ovulation.

Key Words: *Dominant follicle, Infertility, Transvaginal sonography (TVS)s*

Introduction

Infertility is inability of a sexually active couple to achieve pregnancy even after one year of unprotected coitus [1] and 10-15% of reproductive age couples come across this situation. Of the various causes of

female infertility, disorders of ovulation account for about 20-40% and are among the most easily diagnosed and treatable causes of infertility [2].

Imaging plays an important role in evaluation of infertile women and

ultrasonography is the first line investigation in these patients [3,4]. Ultrasound is readily available, safe (radiation free), easy to use, noninvasive and easily repeatable imaging modality for evaluation of ovaries and monitoring ovarian follicular development in infertile women and thus an essential and integral part of both the diagnostic and therapeutic steps in infertility management [4,5]. Even though both transvaginal and transabdominal approach can be used to visualize ovaries, monitor ovarian follicular development and detect ovulation; transvaginal approach allows more frequent and better detection and visualization of ovaries and ovarian follicles, and a serial ultrasonographic monitoring provides a reliable measure of follicular growth and detection of ovulation [6,7]. Ultrasonographic documentation of changes in ovaries during normal cycles and assisted reproductive technology has a great significance and role in infertility treatment which includes detection of ovarian follicles and development of dominant follicle, timing administration and adjustment of ovarian stimulatory drugs, document ovulation, provide guidance during oocyte retrieval and predict and detect ovarian hyperstimulation syndrome [5,8].

This study was undertaken to evaluate the pattern of ovarian follicular growth and to predict and detect ovulation in infertile women seeking treatment in teaching hospital in eastern part of Nepal.

Materials and Methods

Prospective cross-sectional study on 100 consecutive patients with infertility referred for ultrasonographic monitoring of ovarian follicle to Department of Radiodiagnosis and Imaging of Nobel Medical College Teaching Hospital and Research Center, Biratnagar was conducted over a period of 26 months from March 2014 to April 2016. Patients with irregular menstrual

cycles and patients already on ovulation induction drugs were excluded from the study.

The patients were explained about the procedure of transvaginal sonography and informed consent was obtained. Demographic data such as age and duration of marriage were inquired and recorded. Serial transvaginal sonography of the patients was performed in the presence of female attendant using standard procedure daily from day 10 of menstrual cycle till detection of ovulation. The day of ovulation was defined as the day when the ultrasound examination showed disappearance or regression of size of dominant follicle. Following features were assessed and recorded:

- The presence of follicles within the ovary and average dimension of follicles.
- Identification of dominant follicle and side of ovary in which it was seen.
- Changes in dominant follicle (size) on serial ultrasound scan.
- Detection and documentation of ovulation with associated sonographic signs of ovulation such as sudden disappearance of follicle or regression of size, irregularity of margins, echogenic texture within the follicle and fluid in cul-de-sac.

Statistical Analysis

Statistical analysis was performed using SPSS software.

Results

Total of 100 patients referred for follicular monitoring were examined. The age range of the patients was between 19 – 43 years with a mean age of 29.1 years (Table 1). Average duration of marriage being 6.1 years (range 2 – 17 years) with 43 % of patients being married for less than 5 years, 41 % married for between 5 – 10 years and 16 % married for more than 10 years (Table 2).

Table 1: Age Distribution

| Age group (years) | Frequency (n = 100) | Percentage |
|-------------------|---------------------|------------|
| 15-20 | 2 | 2% |
| 21-25 | 11 | 11% |
| 26-30 | 40 | 40% |
| 31-35 | 31 | 31% |
| 36-40 | 13 | 13% |
| 41-45 | 3 | 3% |

Table 2: Marriage Duration

| Duration (years) | Frequency (n = 100) | Percentage |
|------------------|---------------------|------------|
| <5 | 43 | 43% |
| 5-10 | 41 | 41% |
| > 10 | 16 | 16% |

Dominant follicle was seen in right ovary in 54 (54 %) patients, whereas in 46 (46 %) patients dominant follicle was noted in left ovary.

Increase in mean diameter of the dominant follicle was seen in serial ultrasound scan till ovulation, which occurred in all cases by day 16 of menstrual cycle.

Ovulation was observed on 14th, 15th and 16th day of menstrual cycle in 24 (24 %), 40 (40 %) and 36 (36 %) patients respectively. The mean diameter ± SD of dominant follicle on 10th, 11th, 12th, 13th, 14th, and 15th day of menstrual cycle were 11.2 ± 1.3 mm (range: 9.4 – 13.7 mm), 13.4 ± 1.4 mm (range: 11.8 – 15.7 mm), 16.0 ± 1.2 mm (range: 14.1 – 18.0 mm), 18.1 ± 1.6 mm (range: 16.2 – 20.9 mm), 20.1 ± 1.8 mm (range: 18.2 – 24.3 mm) and 22.2 ± 1.8 mm (range: 20.2 – 26.3 mm) respectively. (Table 3).

Table 3: Mean diameter of Dominant follicle

| Day of Menstrual cycle | 10 | 11 | 12 | 13 | 14 | 15 |
|------------------------|-------|-------|-------|-------|-------|-------|
| Mean Diameter | 11.2 | 13.4 | 16.0 | 18.1 | 20.1 | 22.2 |
| ± SD (mm) | ± 1.3 | ± 1.4 | ± 1.2 | ± 1.6 | ± 1.8 | ± 1.8 |

The average daily follicular growth rate ± SD from day 10 of menstrual cycle till detection of ovulation was 2.2 ± 0.2 mm per day and the mean diameter ± SD of dominant follicle on the day prior to ovulation was 21.4 ± 2.8 mm with a range of 17.2 – 26.3 mm.

Sudden disappearance / regression of size of dominant follicle as a sign of ovulation was seen in all cases with irregular margin observed in 91 % of cases. Echogenic texture within the follicle was seen in 86 % of the cases. Whereas in 42 % of cases free fluid was detected in cul-de-sac immediately after ovulation.

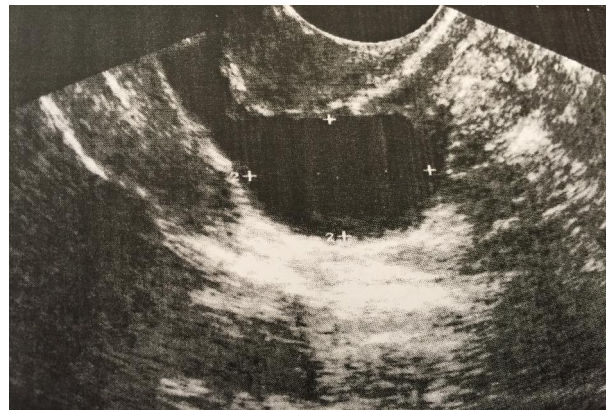


Figure 1: Dominant follicle in right ovary on transvaginal sonography performed on day 14 of menstrual cycle (mean diameter: 23.9 mm)

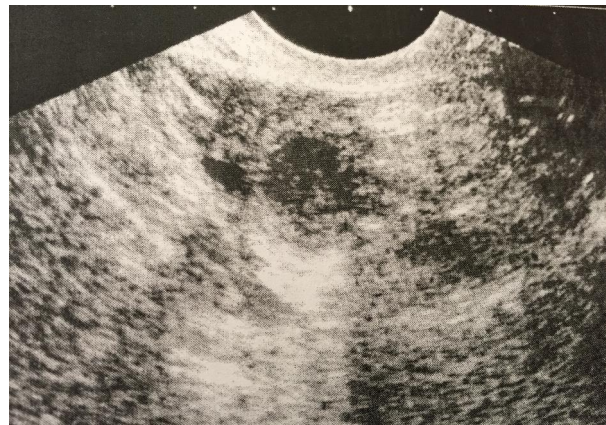


Figure 2: Involution of dominant follicle with increase internal echoes on transvaginal sonography performed on day 15 of menstrual cycle.

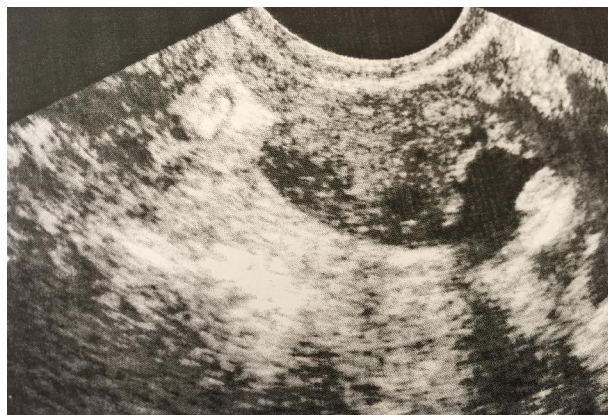


Figure 3: Free fluid in cul-de-sac after ovulation.

Discussion

Infertility is not only the problem of Western countries, but also of developing countries [9] and is overly associated with sentiment and misinformation [5]. Ultrasound is an investigation of choice in infertile women [4] for evaluation of ovaries and monitoring ovarian follicular development.

Majority of patients (40 %) in this study belonged to age group of 26 – 30 years and with 43.0 % of the infertile women in this study were married for less than 5 years. This early seeking for infertility treatment could be due to associated stigma with infertility in our society and couples increased awareness regarding available treatment facilities and importance of early detection and treatment of underlying causes of infertility.

Linear increase in mean diameter \pm SD of dominant follicle by 2.2 ± 0.2 mm per day was seen from day 10 of menstrual cycle till detection of ovulation in this study with the mean diameter \pm SD of dominant follicle on the day prior to ovulation being 21.4 ± 2.8 mm (range 17.2 – 26.3 mm), which was consistent and comparable with other studies [10-16].

Ojengbede OA et al in their study of 39 spontaneous cycles in 34 women (22

infertile and 12 normal volunteers) reported maximum mean follicular diameter prior to ovulation of 21.0 mm with a maximum mean follicular diameter prior to ovulation in infertile women to be 21.4 mm (range 15 – 28 mm) [10]. In a study by Lenz S follicles reached a maximum mean diameter of 20.5 mm with a range of 16 – 25 mm and average daily follicular growth rate of 2.2 mm per day [11]. Follicular growth by 2 - 3 mm a day reaching a mean diameter of about 20 – 24 mm by the time of ovulation was seen in study of Hackeloer BJ et al [12]. According to Sengoku K et al the mean follicle diameter in 28 infertile patients (for 48 cycles) measured the day before ovulation was 22.4 mm with the range of 16 – 27 mm [13]. In a study conducted by Kerin J, day to day preovular growth of follicle was linear with the range of the final diameter of ovarian follicle prior to ovulation to be 17 – 26 mm [14]. According to Bakos et al at ovulation the dominant follicle had a mean diameter of 21.4 mm with a range of 17.4 – 27.0 mm [15]. In a study carried by H M Behre et al on 53 women of age group 18 – 39 years for a total of 150 cycles, the mean follicular diameter on the day before ovulation was 21.5 mm [16]. However, in a study by Hata T et al in 21 infertile Japanese women during 37 menstrual cycles, the maximum mean diameter prior to ovulation was 23.3 mm [17] which was slightly higher than this study.

In the present study, sudden disappearance / regression of size of dominant follicle as a sign of ovulation was seen in all cases. However, in studies of Guermandi E et al [18] and Luciano AA et al [19] in infertile women, rupture of the dominant follicle was evidenced in 96 % and 94 % of cycles respectively. Echogenic texture within the ruptured dominant follicle was seen in 86 % of cases, which was comparable with the study of Ojengbede

OA et al [10] who found the changes in shape and / or size of follicle mostly associated with increased internal echoes as the indices of ovulation in 84.7 % cases. Free fluid in cul-de-sac immediately after ovulation was detected in 42 % of cases which is comparable to the study of Sengoku K et al [20] in which free fluid in cul-de-sac was demonstrated in 41.8 % of cases. However, in a study of Davis JA et al [21] free fluid in cul-de-sac was detected in 26 % of cases in the period immediately after ovulation.

Conclusion

Transvaginal sonography is an excellent imaging investigation for identification of ovarian dominant follicle and a serial ultrasonographic monitoring provides a reliable measure of follicular growth and detection of ovulation, hence have a significant role in infertility management. Linear increase in mean diameter \pm SD of dominant follicle by 2.2 ± 0.2 mm per day was seen from day 10 of menstrual cycle till detection of ovulation with the mean diameter \pm SD of dominant follicle on the day prior to ovulation being 21.4 ± 2.8 mm (range: 17.2 – 26.3 mm). Hence prediction of ovulation depending upon the size of dominant follicle alone may not be accurate due to wide range of mean follicular diameter prior to ovulation; however, infertility management procedures can be carried out when the size of dominant follicle reaches in the range of presumptive ovulation.

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